

Chemically squeezing every drop of ethanol from corn

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Brent Shanks is going down to the molecules to find a little extra ethanol. Shanks, an Iowa State University associate professor of chemical and biological engineering, is leading a research team that's working to develop chemical catalysts that could boost ethanol production by increasing the yield of fermentable sugars from corn.

The idea is to create the chemical catalysts that create single, simple sugars from molecules made of several simple sugars linked together. The simple sugars are the ones that can be fermented to produce ethanol.

Such a process would allow ethanol producers to use all the sugars in corn. And Shanks said that could boost ethanol production by 10 to 15 percent.

The research team includes Bert Chandler, an assistant professor of chemistry at Trinity University in San Antonio, Texas; Sarah Larsen, an associate professor of chemistry at the University of Iowa in Iowa City; and Michael Ladisch, a distinguished professor of agricultural and biological engineering at Purdue University in West Lafayette, Ind.

Shanks, who worked for the Shell Chemical Co. for 11 years, said the petrochemical industry has been developing catalysts and other technologies for working with fossil fuel molecules for about 80 years. Researchers working with corn and other bio-based molecules are just starting to develop catalysts and technologies to improve production of fuels and chemicals.

Shanks' ethanol project is focused on synthesizing and testing catalysts made from a hybrid of organic and inorganic materials. The researchers are working at the nanostructure scale, meaning they're working at the molecular level.

Current ethanol production technology uses enzymes to convert the starch in corn kernels into simple sugars. The simple sugars are fermented into ethanol. Shanks said that process uses about 80 percent of a corn kernel.

The remaining 20 percent of a kernel contains sugar chains that can't be fermented. Shanks and his research team are working to develop a chemical catalyst that will break those sugar chains into the simple sugars that can be fermented into ethanol.

Pulling out those sugars would also boost the protein level of the distillers dried grains left behind by ethanol production. That would make the byproduct more valuable as an animal feed.

Initial tests in the lab have produced promising results, Shanks said.

But he said there's still some research and development work to do before the technology is precise enough to be used in an ethanol plant.

"This research is in an area that makes a lot of sense for Iowa," said Shanks, who studied alternative energy as an Iowa State undergraduate during the energy crisis of the late 1970s and early 1980s. "I think our interest in alternative sources for energy and chemicals is very important to our entire society. We need to come up with alternatives. But I worry about coming up with them fast enough."

Source: Iowa State University

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